

### AUROBAS.

*Auroral displays of August, 1892.*

Date.	Station.	Extent of display.		Remarks.
		Azimuth.	Altitude.	
6	Sault Ste. Marie, Mich..	180 to 270	25	Arch of green color resting on dark segment.
8	Havre, Mont.....	Cov'd 180	Zenith	An arch, with beams.
12	Philadelphia, Pa .....	In north.	25	A diffused white light, with beams, which had a lateral movement toward the west.
12-13	Sault Ste. Marie, Mich..	180 to 270	85	Green color.
12	Bismarek, N. Dak.....	135 to 250	30	Arch, with streamers.
12-13	Rapid City, S. Dak .....		30	Pale beams moved from east to west.

### Auroral displays of July, 1892—Continued.

Date.	Station.	Extent of display.		Remarks.
		Azimuth.	Altitude.	
12	Lander, Wyo .....			Two white beams tinged with green, and yellow beams along horizon.
17	Sault Ste. Marie, Mich..	135 to 225	20	Green color.
19	Sault Ste. Marie, Mich..	180 to 270	20	Green color.
23	Northfield, Vt.....	190 to 235	15	Pale green color.
23	Fort Buford, N. Dak.....	190 to 235	15	Diffused white light, with streamers.
24	Duluth, Minn.....	Cov'd 90	Zenith	Beams of bright light.
28	Alpena, Mich .....	135 to 190	35	Streamers of white light.

## INLAND NAVIGATION.

### STAGE OF WATER IN RIVERS.

The following table shows the danger-points at the various river stations; the highest and lowest stages for the month, with the dates of occurrence, and the monthly ranges:

*Heights of rivers above low-water mark, August, 1892 (in feet and tenths).*

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Height.	Date.	Height.	Date.	
<i>Red River.</i>						
Shreveport, La .....	29.9	6.0	1	1.0	25	5.0
<i>Arkansas River.</i>						
Fort Smith, Ark .....	22.0	5.2	31	1.5	26	3.7
Little Rock, Ark .....	23.0	8.5	1, 31	7.0	13	1.5
<i>Missouri River.</i>						
Fort Buford, N. Dak .....	11.0		1	6.6	28	4.4
Bismarck, N. Dak .....		6.4	1	2.5	31	3.9
Pierre, S. Dak .....	14.0	3.7	1	1.7	31	2.0
Sioux City, Iowa .....	18.7	10.8	1	6.3	28-30	4.5
Omaha, Nebr .....	18.0	11.0	1	7.8	30, 31	3.2
Kansas City, Mo .....	21.0	13.5	1	8.1	31	5.4
<i>Mississippi River.</i>						
Saint Paul, Minn .....	14.0	6.4	1	3.3	29	3.1
La Crosse, Wis .....	11.8	6.9	3	2.8	29	4.1
Dubuque, Iowa .....	16.0	7.9	7-9	4.2	31	3.7
Davenport, Iowa .....	15.0	5.6	10-13	3.2	31	2.4
Keokuk, Iowa .....	14.0	6.4	1	3.7	26	2.7

### Heights of rivers—Continued.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Height.	Date.	Height.	Date.	
<i>Mississippi River—Continued.</i>						
Hannibal, Mo .....	17.0	7.8	1, 2	4.8	27, 28	3.0
Saint Louis, Mo .....	30.0	18.8	1	9.5	29-31	9.3
Cairo, Ill .....	40.0	20.7	1	10.3	31	10.4
Memphis, Tenn .....	33.0	17.6	1	7.8	31	9.8
Vicksburg, Miss .....	41.0	36.6	1	11.6	31	25.0
New Orleans, La .....	13.0	13.5	1	4.7	29-31	8.8
<i>Ohio River.</i>						
Parkersburg, W. Va. ....	38.0	7.0	1, 2	2.7	12	4.3
Cincinnati, Ohio .....	45.0	10.8	7	5.5	30, 31	5.3
Louisville, Ky .....	24.0	5.8	9	3.6	31	2.2
<i>Cumberland River.</i>						
Nashville, Tenn .....	40.0	3.5	1	1.7	22	1.8
<i>Tennessee River.</i>						
Chattanooga, Tenn .....	33.0	4.9	6	2.7	25	2.2
<i>Monongahela River.</i>						
Pittsburg, Pa .....	29.0	6.7	29	5.0	13	1.7
<i>Savannah River.</i>						
Augusta, Ga .....	32.0	11.9	26	6.7	23	5.2
<i>Willamette River.</i>						
Portland, Oregon .....	15.0	8.0	1	2.5	31	5.5
<i>Susquehanna River.</i>						
Harrisburg, Pa .....	17.0	4.2	16	1.8	3, 24	2.4
<i>Alabama River.</i>						
Montgomery, Ala .....	48.0	18.5	20	2.4	6, 7	16.1

## STATE WEATHER SERVICES.

[Temperature in degrees Fahrenheit; precipitation, including melted snow, in inches and hundredths.]

The following extracts and summaries are republished from reports for August, 1892, of the directors of the various state weather services:

### ALABAMA.

*Temperature.*—The mean was 0.2 below the normal; maximum, 100, at Brewton, 12th; minimum, 56, at Valley Head, 4th and 14th; greatest monthly range, 38, at Jasper; least monthly range, 16, at Cheplatepec.

*Precipitation.*—The average was 2.03 above the normal; greatest monthly, 13.55, at Brewton; least monthly, 2.19, at Carrollton.

*Wind.*—Prevailing direction, east.—*P. H. Mell, Observer, Weather Bureau, Auburn, director.*

### ARIZONA.

*Temperature.*—Maximum, 123, at Fort Mohave, 5th; minimum, 46, at Fort Apache, 30th, and at Holbrook, 30th and 31st; greatest monthly range, 60, at Fort Mohave; least monthly range, 28, at Farleys Camp.

*Precipitation.*—Greatest monthly, 3.40, at Walnut Ranch; least monthly, 0.00, at Fort Mohave, Phoenix, and Rancho del Pueblo.

*Wind.*—Prevailing direction, southwest.—*J. C. Hayden, Observer, Weather Bureau, Tucson, director.*

### ARKANSAS.

*Temperature.*—The mean was 0.2 above the normal; maximum, 106, at Keesees Ferry, 6th; minimum, 47, at Fayetteville, 31st; greatest monthly range, 54, at Keesees Ferry; least monthly range, 24, at Greenville, Miss.

*Precipitation.*—The average was 1.58 above the normal; greatest monthly, 8.54, at Dallas; least monthly, 0.78, at Harrison.

*Wind.*—Prevailing direction, south.—*M. F. Locke, Commissioner of Agriculture, Little Rock, director; F. H. Clarke, Local Forecast Official, Weather Bureau, assistant.*

### CALIFORNIA.

*Temperature.*—The mean was 0.2 below the normal; maximum, 117, at

Needles, 4th and 17th; minimum, 38, at Nordhoff, 11th; greatest monthly range, 72, at Nordhoff; least monthly range, 14, at Ventura.

*Precipitation.*—The average was 0.06 below the normal; greatest monthly, 0.11, at Julian; least monthly, 0.00, at a number of stations.

*Wind.*—Prevailing direction, west.—*J. A. Barwick, Observer, Weather Bureau, Sacramento, director.*

### COLORADO.

*Temperature.*—The mean was 2.0 above the normal; maximum, 108, at Lamar, 4th; minimum, 21, at Breckenridge, 30th; greatest monthly range, 76, at Steamboat Spring; least monthly range, 43, at Cumbres.

*Precipitation.*—The average was 1.00 below the normal; greatest monthly, 5.29, at Avoca; least monthly, 0.00, at Rico, Saint Cloud, and Steamboat Spring.

*Wind.*—Prevailing direction, west.—*W. S. Miller, Observer, Weather Bureau, Denver, director.*

### FLORIDA.

*Temperature.*—Maximum, 101, at Micco, 12th; minimum, 67, at Plant City, 8th; greatest monthly range, 33, at Micco; least monthly range, 15, at Clermont.

*Precipitation.*—Greatest monthly, 13.74, at Oxford; least monthly, 1.59, at Key West.

*Wind.*—Prevailing direction, southeast.—*E. R. Demain, Observer, Weather Bureau, Jacksonville, director.*

### GEORGIA.

*Temperature.*—Maximum, 100, at Cordele, 1st; minimum, 58, at Lafayette, 14th; greatest monthly range, 39, at Adairsville; least monthly range, 18, at Hepzibah.

**Precipitation.**—Greatest monthly, 13.89, at Thomasville; least monthly, 2.23, at Hepzibah.

**Wind.**—Prevailing direction, west.—*Park Morrill, Local Forecast Official, Weather Bureau, Atlanta, director.*

#### IDAHO.

**Temperature.**—Maximum, 102, at Boise Barracks, 3d, and at Payette, 20th; minimum, 23, at Henrys Lake, 29th; greatest monthly range, 70, at Boise Barracks; least monthly range, 44, at Ruthburg.

**Precipitation.**—Greatest monthly, 1.12, at Kootenai; least monthly, 0.00, at Boise Barracks, Payette, and Ruthburg.

**Wind.**—Prevailing direction, south.—*J. H. Smith, Observer, Weather Bureau, Idaho Falls, director.*

#### ILLINOIS.

**Temperature.**—The mean was 0.4 above the normal of the last 17 years; maximum, 100, at Greenville, 8th; minimum, 41, at Philo, 31st.

**Precipitation.**—The average was 0.92 above the normal of the last 14 years; greatest monthly, 6.07, at Pana; least monthly, 0.32, at Hennepin.

**Wind.**—Prevailing direction, northeast.—*John Craig, Observer, Weather Bureau, Springfield, director.*

#### INDIANA.

**Temperature.**—The mean was 2.0 above the normal; maximum, 98, at Angola, 18th; minimum, 42, at Connersville, 31st; greatest monthly range, 48, at Connersville, Rockville, Lafayette, and Logansport; least monthly range, 28, at New Albany.

**Precipitation.**—The average was 0.74 below the normal; greatest monthly, 5.27, at Butlerville; least monthly, 0.87, at Hawpatch.

**Wind.**—Prevailing direction, northeast.—*Prof. H. A. Huston, Lafayette, director; C. F. R. Wappenhans, Local Forecast Official, Weather Bureau, assistant.*

#### IOWA WEATHER AND CROP SERVICE.

**Temperature.**—The mean was about normal; maximum, 102, at Atlantic and Glenwood, 8th; minimum, 40, at Ames, 31st; greatest monthly range, 53, at Ames, Glenwood, and Blockton; least monthly range, 32, at Richland.

**Precipitation.**—The average was about 1.00 below the normal; greatest monthly, 4.69, at Larrabee; least monthly, 0.65, at Maxon.

**Wind.**—Prevailing direction, southeast.—*J. R. Sage, Des Moines, director; G. M. Chappel, Local Forecast Official, Weather Bureau, assistant.*

#### KANSAS.

**Temperature.**—The mean was 0.1 below the normal; maximum, 111, at Lakin, 4th; minimum, 36, at Hays City, 23d; greatest monthly range, 67, at Hays City; least monthly range, 43, at Lawrence.

**Precipitation.**—The average was 0.84 above the normal; greatest monthly, 7.76, at Hesston; least monthly, 0.15, at Lakin.

**Wind.**—Prevailing direction, south.—*Prof. J. T. Lovewell, Topeka, director; T. B. Jennings, Observer, Weather Bureau, assistant.*

#### KENTUCKY.

**Temperature.**—The mean was about normal; maximum, 96, at Shelbyville, 8th and 9th; minimum, 45, at Shelbyville, 31st; greatest monthly range, 51, at Shelbyville; least monthly range, 26, at Caddo.

**Precipitation.**—The average was about 0.50 below the normal; greatest monthly, 8.45, at Williamsburg; least monthly, 1.23, at Canton.

**Wind.**—Prevailing direction, southwest.—*Frank Burke, Observer, Weather Bureau, Louisville, director.*

#### LOUISIANA.

**Temperature.**—The mean was 1.3 below the normal; maximum, 100, at Schriever, 5th; minimum, 53, at Winnsboro, 31st; greatest monthly range, 43, at Winnsboro; least monthly range, 18, at Port Eads.

**Precipitation.**—The average was 1.57 above the normal; greatest monthly, 9.76, at Clinton; least monthly, 2.10, at Winnsboro.

**Wind.**—Prevailing direction, southwest.—*George E. Hunt, Local Forecast Official, Weather Bureau, New Orleans, director.*

#### MARYLAND.

**Temperature.**—Maximum, 101, at Cumberland (a), 9th; minimum, 56, at Boettcherville, 20th, and at Edgemont, 14th; greatest monthly range, 43, at Edgemont; least monthly range, 15, at Jewell.

**Precipitation.**—Greatest monthly, 4.10, at Fallston; least monthly, 0.58, at Taneytown.

**Wind.**—Prevailing direction, northwest.—*Dr. William B. Clark, Johns Hopkins University, Baltimore, director; Prof. Milton Whitney, Maryland Agricultural College, secretary and treasurer; C. P. Cronk, Observer, Weather Bureau, in charge.*

#### MICHIGAN.

**Temperature.**—The mean was 2.0 above the normal; maximum, 98, at Washington, 9th; minimum, 29, at McMillan, 20th; greatest monthly range, 61, at Sand Beach; least monthly range, 35, at White Pigeon.

**Precipitation.**—The average was 0.42 below the normal; greatest monthly, 8.71, at Harrisville; least monthly, 0.45, at Marquette.

**Wind.**—Prevailing direction, southwest.—*E. A. Evans, Local Forecast Official, Weather Bureau, Detroit, director.*

#### MISSISSIPPI.

**Temperature.**—The mean was 0.6 below the normal; maximum, 100, at

Lake and Vaiden, 21st; minimum, 50, at Corinth, 24th and 25th; greatest monthly range, 44, at Corinth; least monthly range, 21, at Ship Island.

**Precipitation.**—The average was 1.21 above the normal; greatest monthly, 9.66, at Ship Island; least monthly, 0.77, at Lake.

**Wind.**—Prevailing direction, southeast.—*R. B. Fulton, Observer, Weather Bureau, University, director.*

#### NEBRASKA.

**Temperature.**—Maximum, 108, at Mullen, 7th; minimum, 36, at Kimball, 30th; greatest monthly range, 68, at Kimball; least monthly range, 42, at Falls City.

**Precipitation.**—Greatest monthly, 6.90, at West Point; least monthly, 1.16, at Gering.

**Wind.**—Prevailing direction, southeast.—*Prof. Goodwin D. Swezey, Crete, director; G. A. Loveland, Observer, Weather Bureau, assistant.*

#### NEVADA.

**Temperature.**—The mean was 0.9 below the normal; maximum, 105, at Elko, 1st; minimum, 20, at Sunnyside, 27th.

**Precipitation.**—The average was 0.83 below the normal; greatest monthly, 0.75, at Pioche; least monthly, 0.00, at a number of stations.—*Prof. Charles W. Friend, Carson City, director; F. A. Carpenter, Observer, Weather Bureau, assistant.*

#### NEW ENGLAND.

**Temperature.**—The mean was 0.1 above the normal; maximum, 97, at Taunton (d), 10th; minimum, 34, at West Milan, 23d; greatest monthly range, 52, at Stratford; least monthly range, 26, at Woods Holl.

**Precipitation.**—The average was 1.05 above the normal; greatest monthly, 11.23, at Grafton; least monthly, 0.42, at Adams (b).

**Wind.**—Prevailing direction, southwest.—*J. Warren Smith, Observer, Weather Bureau, Boston, Mass., director.*

#### NEW JERSEY.

**Temperature.**—The mean was 1.4 above the normal; maximum, 99, at New Brunswick, 9th; minimum, 45, at Tenafly, 23d; greatest monthly range, 45, at Belvidere and Tenafly; least monthly range, 25, at Atlantic City.

**Precipitation.**—The average was 1.11 below the normal; greatest monthly, 5.65, at Vineland; least monthly, 0.72, at Cape May.

**Wind.**—Prevailing direction, southwest.—*E. W. McGann, Observer, Weather Bureau, New Brunswick, director.*

#### NEW MEXICO.

**Temperature.**—Maximum, 105, at Embudo, 17th; minimum, 26, at Dulce, 29th; greatest monthly range, 70, at Dulce; least monthly range, 28, at La Lunz.

**Precipitation.**—Greatest monthly, 1.52, at Hills Ranch; least monthly, 0.00, at Los Lunas.

**Wind.**—Prevailing directions, southeast, southwest, and west.—*H. B. Hersey, Observer, Weather Bureau, Santa Fe, director.*

#### NEW YORK.

**Temperature.**—The mean was 0.5 below the normal; maximum, 98, at Eden Center, 8th; minimum, 41, at Arcade, 7th; greatest monthly range, 51, at Mount Morris; least monthly range, 31, at Setauket and Willets Point.

**Precipitation.**—The average was 2.55 above the normal; greatest monthly, 11.78, at North Hammond; least monthly, 2.01, at Watkins.

**Wind.**—Prevailing direction, southwest.—*Prof. E. A. Fieries, Dean of the College of Civil Engineering, Cornell University, Ithaca, director; R. M. Hardinge, Observer, Weather Bureau, assistant.*

#### NORTH CAROLINA.

Crops were considerably damaged by drought throughout the state.

**Temperature.**—The mean was 1.4 above the normal; maximum, 105, at Chapel Hill, 10th; minimum, 49, at Bakersville, 14th; greatest monthly range, 51, at Douglas; least monthly range, 15, at Hatteras.

**Precipitation.**—The average was 2.32 below the normal; greatest monthly, 10.15, at Horse Cove; least monthly, 0.82, at Chapel Hill.

**Wind.**—Prevailing direction, southwest.—*Dr. Herbert B. Battle, Raleigh, director; C. F. von Herrmann, Observer, Weather Bureau, assistant.*

#### NORTH DAKOTA.

Drought prevailed in the western portion of the state and caused much damage to grain and grass.

**Temperature.**—The mean was 2.4 above the normal; maximum, 105, at Woodbridge, 15th; minimum, 24, at Woodbridge, 30th; greatest monthly range, 81, at Woodbridge; least monthly range, 54, at Saint John.

**Precipitation.**—The average was 0.23 above the normal; greatest monthly, 4.07, at Wild Rice; least monthly, 0.36, at Yule.

**Wind.**—Prevailing direction, southeast.—*W. H. Fallon, Observer, Weather Bureau, Bismarck, director.*

#### OHIO.

**Temperature.**—The mean was 1.0 above the normal; maximum, 99, at Leipsic, 16th; minimum, 45, at Orangeville, 29th; greatest monthly range, 51, at Van Wert; least monthly range, 35, at Gratiot.

**Precipitation.**—The average was 0.31 below the normal; greatest monthly, 6.15, at Ohio State University; least monthly, 0.76, at Hackney.

**Wind.**—Prevailing direction, southwest.—*Prof. B. F. Thomas, Columbus, director; C. M. Strong, Observer, Weather Bureau, secretary and assistant.*

## OKLAHOMA.

*Temperature.*—Maximum, 109, at Gate City, 5th; minimum, 47, at Gate City, 30th; greatest monthly range, 62, at Gate City; least monthly range, 31, at Lehigh.

*Precipitation.*—Greatest monthly, 9.03, at South McAlester; least monthly, 1.72, at Guthrie.

*Wind.*—Prevailing direction, south.—*J. I. Widmeyer, Observer, Weather Bureau, Oklahoma City, director.*

## PENNSYLVANIA.

*Temperature.*—The mean was 1.0 above the normal; maximum, 99, at Selins Grove, 9th; minimum, 42, at Saegertown, 29th; greatest monthly range, 53, at Saegertown; least monthly range, 32, at Erie and Dyberry.

*Precipitation.*—The average was 0.50 below the normal; greatest monthly, 7.64, at Columbus; least monthly, 1.07, at McConnellsburg.

*Wind.*—Prevailing direction, northwest.—*Under direction of the Franklin Institute, Philadelphia; H. L. Ball, Observer, Weather Bureau, assistant.*

## SOUTH CAROLINA.

*Temperature.*—Maximum, 96, at Florence, 11th; minimum, 59, at Greenville, 19th.

*Precipitation.*—Greatest monthly, 9.72, at Columbia; least monthly, 1.38, at Statesburg.

*Wind.*—Prevailing direction, southwest.—*A. P. Butler, Observer, Weather Bureau, Columbia, director.*

## SOUTH DAKOTA.

*Temperature.*—The mean was 2.2 above the normal; maximum, 110, at Hotch City, 16th; minimum, 31, at De Smet, 30th; greatest monthly range, 69, at Frankfort; least monthly range, 45, at Ashcroft.

*Precipitation.*—The average was 0.20 above the normal; greatest monthly, 6.33, at Millbank; least monthly, 0.63, at Pierre.

*Wind.*—Prevailing direction, southeast.—*S. W. Glenn, Local Forecast Official, Weather Bureau, Huron, director.*

## TENNESSEE WEATHER AND CROP SERVICE.

*Temperature.*—The mean was 1.0 above the normal; maximum, 98, at Milan, 7th, and at Covington (b), 8th; minimum, 52, at Clarksville, 31st; greatest monthly range, 44, at Covington; least monthly range, 25, at Bethel Springs.

*Precipitation.*—The average was 0.21 above the normal; greatest monthly, 8.17, at Jacksboro; least monthly, 2.07, at Lynnville.

*Wind.*—Prevailing direction, southeast.—*J. B. Marbury, Local Forecast Official, Weather Bureau, Nashville, director.*

## TEXAS.

*Temperature.*—The mean was 2.7 below the normal; maximum, 105, at Childress, 7th, and at Roby, 12th; minimum, 47, at Hartley, 31st; greatest monthly range, 55, at Hartley; least monthly range, 16, at Flower Bluff.

*Precipitation.*—The average was 1.88 above the normal; greatest monthly, 9.10, at Camp Eagle Pass; least monthly, 0.07, at El Paso.

*Wind.*—Prevailing direction, southeast.—*D. D. Bryan, Galveston, director; I. M. Cline, Local Forecast Official, Weather Bureau, assistant.*

## UTAH.

Severe drought in the southern part of the territory caused a loss of cattle on the ranges.

*Temperature.*—Maximum, 113, at Saint George, 4th; minimum, 23, at Soldiers Summit, 28th, and at Scofield, 29th; greatest monthly range, 72, at Soldiers Summit; least monthly range, 55, at Logan.

*Precipitation.*—Greatest monthly, 2.13, at Soldiers Summit; least monthly, 0.00, at several stations.—*G. N. Salisbury, Observer, Weather Bureau, Salt Lake City, director.*

## VIRGINIA.

*Temperature.*—Maximum, 104, at Nottoway, 10th; minimum, 45, at Big Stone Gap, 31st; greatest monthly range, 48, at Nottoway; least monthly range, 27, at Birdsnest.

*Precipitation.*—Greatest monthly, 8.84, at Stannardsville; least monthly, 0.80, at Lynchburg.

*Wind.*—Prevailing direction, southwest.—*Dr. E. A. Craighill, Lynchburg, director; J. N. Ryker, Observer, Weather Bureau, assistant.*

## WEST VIRGINIA.

Drought prevailed during the month and vegetation and pastures were more or less damaged.

*Temperature.*—Maximum, 96, at Morgantown, 17th; minimum, 41, at Davis, 14th and 15th; greatest monthly range, 47, at Davis; least monthly range, 22, at Huntington.

*Precipitation.*—Greatest monthly, 6.95, at Weston; least monthly, 0.71, at Spencer.

*Wind.*—Prevailing direction, west.—*W. W. Dent, Observer, Weather Bureau, Parkersburg, director.*

## WISCONSIN.

*Temperature.*—The mean was about 1.0 below the normal; maximum, 96, at Richland Center, 8th; minimum, 32, at Rhinelander, 31st.

*Precipitation.*—The average was about 1.00 below the normal, except in a small area bordering on Lake Michigan, where it was slightly above; greatest monthly, 6.21, at Raymond; least monthly, 1.12, at Cadiz.

*Wind.*—Prevailing direction, southeast.—*W. L. Moore, Local Forecast Official, Weather Bureau, Milwaukee, director.*

## WYOMING.

*Temperature.*—Maximum, 105, at Wheatland, 4th; minimum, 29, at Camp Pilot Butte, 29th; greatest monthly range, 67, at Wheatland; least monthly range, 54, at Lander.

*Precipitation.*—Greatest monthly, 1.10, at Wheatland; least monthly, 0.00, at Casper.

*Wind.*—Prevailing direction, west.—*E. M. Ravenscraft, Observer, Weather Bureau, Cheyenne, director.*

## CONTRIBUTIONS AND ORIGINAL ARTICLES.

## THE WARM WAVES OF JULY AND AUGUST, 1892.

[By E. B. GARRIOTT, Weather Bureau.]

Warm waves and hot winds are distinctly dissimilar types of the same class of phenomena. In the United States warm waves are the result of cyclonic wind circulation whereby air over an extended area is replaced by air drawn from warmer and more southern latitudes. When the warm air passes for a lengthened period over districts where the soil is dry, where vegetation is not cooled by the evaporation of moisture, and where an absence of moisture in the air subjects the earth to the full force of the sun's rays, the dry, withering heat of the hot wind is experienced.

The periods of high temperature of the latter part of July and the early part of August were notable in that they partook somewhat of the character of both of the types referred to. The July warm wave produced exceptionally high temperatures; its prevalence was generally unattended, however, by hot winds, owing to previous abundant precipitation which had stored the earth with moisture. The warm wave of the first decade of August following closely the July dry and heated period was severely felt. In some districts drought conditions prevailed, and hot winds were destructive to vegetation.

The July warm wave appeared over Montana on the 18th, with maximum temperature 93° at Havre. It occupied the Missouri Valley from the 18th to the 27th, with daily maximum temperature above 90°, and a maximum of 100° at Omaha, Nebr., on the 23d. In the middle and upper Mississippi valleys the maximum was above 90° from the 22d to the 29th, with highest readings on the 24th, when 96° was registered at Saint Louis, Mo. In the Ohio Valley the heated period began on the 22d, and the daily maximum was above 90° until the 29th, with an extreme of 98° at Cincinnati, Ohio, on the 24th. In the middle Atlantic and New England states the intense heat continued from the 24th to the 30th, the highest temperature being reached on the 26th, when the maximum was 96° at Boston, Mass., 101° at Philadelphia, Pa., 99° at Washington, D. C., and 100° at Lynchburg, Va. The August

warm wave appeared over Montana on the 3d, with maximum temperature 97° and 98° at Havre and Miles City, respectively. It extended over the Missouri Valley on the 4th, where the temperature continued high until the 8th, with daily maximum above 100°. The heated period continued in the middle and upper Mississippi valleys from the 5th to the 9th, with daily maximum above 90°, the highest reading at Saint Louis, Mo., 97°, being noted on the 8th. In the Ohio Valley the temperature ranged high from the 6th to the 9th, although the heat was less intense than that experienced in July. Likewise in the middle Atlantic and New England states, where the warm wave lingered from the 8th to the 11th, the temperature was lower than in the latter part of July.

A prominent fact noted in the investigation of these and other periods of intense heat is the sluggish movement of the warm wave crests over the central valleys and the Eastern States; two to three days are required for the development of extreme temperatures, and several days are required for the earth and atmosphere to cool to the normal condition. The sluggish movement is apparently due to a stagnation of the more general atmospheric conditions, whereby winds are permitted to blow persistently from warmer latitudes. Warm waves of the central and eastern districts of the United States are attended by winds which blow not only from warmer latitudes, but also from the interior; they are attended by south to southwest winds. The conditions by which these winds are produced over the sections referred to are low barometric pressure over the north-central and northwestern districts, and high pressure over the southeastern states. A continuation of this distribution of pressure is necessary to the persistence of the warm wave and also to the attainment of exceptionally high temperature. The temperature in districts visited by a warm wave is at times higher than the temperature in regions to the windward; this is particularly true in the case of long continued warm periods. In such cases the hot wind element is developed. The earth's surface is gradually dried by the warm winds, and when the supply of moisture it contains is exhausted and it is no longer cooled by the evaporation of moisture it becomes heated; it acts as a receiver and storer of heat. The